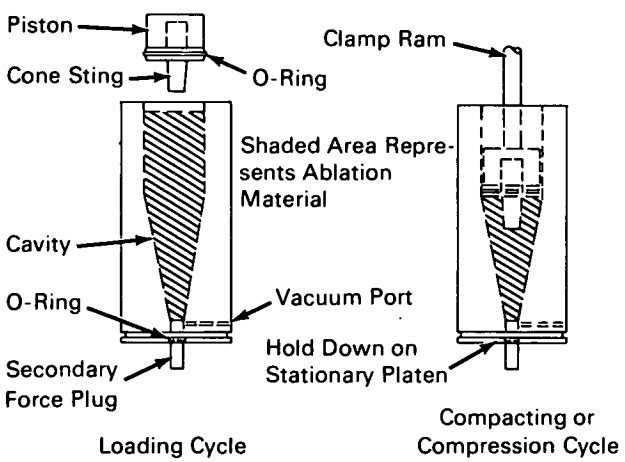
NASA TECH BRIEF

Low Temperature Ablation Models Made by Pressure/Vacuum Application

The problem:

Cone models made of low-temperature subliming materials (paradichlorobenzene or camphor) have been used to simulate the ablation process in conventional wind tunnels. However, some fabrication methods have produced models with poor structural integrity and have been associated with toxic and explosive vapors given off by the molten ablative material. Although a technique of casting outer shells of ablative material that are fitted over a conical substructure reduces the vapor hazard, these models also exhibit poor structural integrity.



The solution:

A method has been developed that employs high pressure combined with a strong vacuum force to compact the models into the desired conical shape. This eliminates the vapor hazard and results in high material density that provides excellent structural integrity.

How it's done:

The ablative material is placed in a specially designed mold (see fig.) consisting of a cavity, a primary force plug (piston) and a secondary force plug. A cone support sting is slip fitted into the piston and a secondary force plug is located in the base of the mold. Initial volume of ablative material placed in the mold is about three times the desired final cone volume (three-to-one bulk factor). O-rings on the piston and mold base provide a hermetic seal.

Vacuum is applied to the base of the mold prior to the compression cycle to remove all air trapped in the mold. A hydraulic press is used to ram the piston into the mold with a suitable pressure. To ensure equal pressure throughout the mold, sufficient force is applied to the secondary force plug to just overcome the original force on the piston. When the piston begins slight movement out of the mold, pressure on the secondary force plug is adjusted to balance precisely the force on the piston, restricting further movement. Position of the piston and secondary force plug is adjusted to correct shape of the final molded configuration. The material, now in a viscous hydrostatic state, is allowed to solidify under pressure for a period of two hours, the pressure is slowly reduced, and the cone frustum is removed from the mold.

Notes:

1. Pressure of about 7000 psi was used with paradichlorobenzene as the ablative material but would be varied for other materials.
2. Requests for further information may be made to:
   Technology Utilization Officer
   Langley Research Center
   Hampton, Virginia 23365
   Reference: B70-10578

(continued overleaf)

Patent status:

No patent action is contemplated by NASA.

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